

NEMULA, A NEW GENUS OF NEMINIDAE
(DIPTERA) FROM MADAGASCAR

AMNON FREIDBERG

Department of Zoology, The George S. Wise Faculty of Life Sciences, Tel Aviv University, Tel Aviv 69978, Israel.

Abstract.—*Nemula*, a new genus of acalyptrate flies, and three new species (*N. argentata*, *N. longarista* and *N. major*) are described from Madagascar. The genus is placed in the family Neminidae, which is raised from a subfamily of Aulacigastridae to full family status.

Key Words: Diptera, Neminidae, *Nemula*, *Nemula argentata*, *Nemula longarista*, *Nemula major*, Madagascar

McAlpine (1983) proposed the subfamily Nemininae in the Aulacigastridae for the genera *Nemo* (Australian, six species) and *Ningulus* (South African, one species), both of which he also described. McAlpine (1985) added a new species of *Nemo* from Papua New Guinea and characterized three species groups within the genus. Ferrar (1987) mentioned biological data for Nemininae, and Evenhuis (1989) cataloged the Australasian species. These few papers comprise the available literature on this uncommon subfamily.

In his excellent treatment of the group, McAlpine (1983) separated the Aulacigastridae into two subfamilies, the Nemininae (with *Nemo* and *Ningulus*) and the Aulacigastrinae (with *Aulacigaster* Macquart and *Schizochroa* Hennig), but he synonymized *Schizochroa* with *Aulacigaster*, resulting in a monobasic subfamily Aulacigastrinae. McAlpine (1983) presented 10 characters that the Neminidae and Aulacigastridae share, but recognized that several of them were of little value as indicators of relationships. Conversely, McAlpine presented 18 characters to separate the Nemininae from

the Aulacigastrinae and also stated: "I . . . place the Nemininae in the family Aulacigastridae as the family of best fit, although I find it easier to give evidence of their taxonomic distinction than convincing evidence for uniting them." Based on a preliminary study of about 35 species of *Aulacigaster* (most undescribed; Freidberg & Mathis, in preparation), discussions with D. K. McAlpine and W. N. Mathis, and the present study, I fully support the above statement and therefore raise the Nemininae to family rank. Mathis and I also support the above mentioned synonymy of *Aulacigaster* and *Schizochroa*.

The present study was initiated during a collecting trip to Madagascar, when, in one week, three new species of an undescribed genus of Neminidae were collected. The collection of one species each in the northern, central-eastern and southern parts of the island during such a short period is undoubtedly an indication of a much richer fauna of this family that is still awaiting discovery on this island (see also McAlpine 1983).

Terminology essentially follows McAlpine (1981).

Family Neminidae McAlpine,

NEW STATUS

The family was characterized by McAlpine (1983), as the subfamily Nemininae in the Aulacigastridae. *Nemula*, the new genus described below, fits very closely McAlpine's (1983) characterization of the Nemininae, which he compared to Aulacigastrinae. This characterization is repeated here, as a family diagnosis, with some modifications necessary to accommodate the new genus (deviations from McAlpine's characterization are explained in parentheses):

1. Frons with pair of convergent (according to McAlpine, sometimes inconspicuous) interfrontal setae near ptilinal suture.
2. Postocellar (= postvertical) seta present.
3. Rays of arista dense, not seriate.
4. Arista 3-segmented, entirely microtrichose (in *Nemo* and *Ningulus*) or bare basally (in *Nemula* no rays are visible on the two proximal aristomeres and on the short thick base of the distal aristomere).
5. Apical pair of scutellar setae erect.
6. Anepisternum bare (in *Nemo* and *Ningulus*) or with 1 tiny seta (in *Nemula*).
7. Anepimeron with 1 or more setulae.
8. Prosternum much longer than wide.
9. Sclerotized part of subcosta reaching much less than halfway from humeral crossvein to costal break (in *Nemula* the subcosta is entirely unsclerotized and barely visible).
10. Crossvein r-m beyond middle of compound cell dm+bm.
11. Cell dm more than half as wide as cell m at level of crossvein dm-cu.
12. Terminal segment of tarsus subtriangular, depressed.
13. Female preabdomen of 4 segments.
14. Female postabdomen very long when extended (about as long as preabdomen).
15. Surstylus loosely articulated with epanthrium.
16. Male terminalia without bacilliform sclerites.
17. Distiphallus long, usually densely spinulose, asymmetrically curved (not spinulose in *Nemula*).
18. Ejaculatory apodeme much reduced or apparently absent.

KEY TO THE GENERA OF NEMINIDAE

1. Head strongly depressed, distinctly longer than high; fronto-orbital setae numerous, short; anterior notopleural seta inserted more dorsally than posterior notopleural seta; postalar seta present; scutellum with 3-4 (pairs) setae (only 2 pairs in an undescribed species from Zimbabwe); apical spur of hind tibia short but strong (South Africa) *Ningulus* McAlpine
- Head not depressed, about as high as long or distinctly higher than long; fronto-orbital setae 1-2, at least 1 long; posterior notopleural seta inserted more dorsally than anterior notopleural seta; postalar seta lacking; scutellum with 2 pairs of setae; apical spur of hind tibia very weak 2
2. Wing: Stem of vein R, from level of humeral crossvein to fork of vein R₁ distinctly shorter than vein R₁, vein R₂₊₃ and usually also than common stem of veins R₂₊₃ and R₄₊₅ (in other words: all forks of vein R are in proximal ¼ of wing); cell dm narrow, almost parallel sided and truncate apically. Outer vertical seta present; 2 long fronto-orbital setae, anterior proclinate, posterior reclinate (Australia, Papua New Guinea) *Nemo* McAlpine
- Wing (Figs. 10-12): Stem of vein R, from level of humeral crossvein to fork of vein R₁, distinctly longer than vein R₁ and common stem of veins R₂₊₃ and R₄₊₅, longer or as long as vein R₂₊₃ (in other words, all forks of vein R are in second proximal ¼ of wing); cell dm strongly widened to level of crossvein r-m; crossvein dm-cu strongly oblique, resulting in distally pointed cell dm. Outer vertical seta absent; 1 long reclinate or proclinate fronto-orbital seta, occasionally with additional anterior reclinate setula (Madagascar) *Nemula* new genus

Nemula Freidberg, NEW GENUS

Type species: *Nemula longarista* new species, by present designation.

Nemula was carefully compared to the detailed descriptions of the two other congeneric genera. The main characters distinguishing it from both genera are the wing venation and chaetotaxy: stem of vein R, distad of level of humeral crossvein, distinctly longer than vein R_1 , longer than common stem of veins R_{2+3} and R_{4+5} , longer or as long as vein R_{2+3} ; cell dm strongly widened to level of crossvein r-m; crossvein dm-cu strongly oblique, resulting in distally pointed cell dm; cell cup small and wide basally, located far basally, overlapping cell dm only along $\frac{1}{10}$ length of the latter; only 1 (apparently the inner) vertical seta present; 1 long fronto-orbital seta, usually proclinate; anepisternum with small seta.

Nemula is similar to *Nemo* and agrees with most of its characters, as given by McAlpine (1983). The following are differences from McAlpine's original description of *Nemo*:

Head: Occiput concave, as in *Nemo*, not flat as in original description of *Nemo*; eyes without short interfacetal setulae; postocellar (= postvertical) setae short or long, divergent; only 1 vertical seta (not 2) present, slightly eclinate but, judging from its insertion, it is probably inner vertical; no additional seta present posterior to it; 1 strong fronto-orbital seta, on vertex or more anteriorly, proclinate (2 spp.) or reclinate (1 sp.), with or without additional, much shorter, reclinate seta or setula at about midheight of frons, both aligned longitudinally; ventroclinate peristomal (= subvibrissal) setae gradually become dorsoclinate vibrissal setae, without clear demarcation; nor is there demarcation between this series and genal seta in 2 spp.; arista 1–2.5 times as long as head, with rather long rays ("hairs"), extended from narrowed region of terminal aristomere to tip, but not visible on basal aristomeres; palpus with 1–3 setulae apically.

Thorax: Scutum as long as wide or wider; scutellum rather wide, about twice as wide as long; prosternum well sclerotized,

longer than wide; anepimeron with 1 proclinate or dorsoclinate seta; notopleural setae 2, subequal or posterior one much longer; 1–2 dorsocentral setae; anterior dorsocentral seta, if present, at normal placement; posterior dorsocentral seta inserted very laterally; 1 intra-alar (perhaps this seta is the supra-alar) seta; basal scutellar seta subequal to, or much shorter than, apical seta; anepisternal seta present, small, dorsoclinate; thorax, or at least scutum, partly or predominantly dark.

Legs: Hind femur with 1 or few preapical dorsal setae.

Wing: Costal break present (2 spp.) or lacking (1 sp.); subcosta as in *Nemo*, although weaker, closer to vein R_1 , and barely visible; stem of vein R, from level of humeral crossvein to fork of vein R_1 , unusually long, distinctly longer than vein R_1 and common stem of veins R_{2+3} and R_{4+5} , longer or as long as vein R_{2+3} (in other words, all forks of vein R are in second proximal $\frac{1}{4}$ of wing); crossvein bm-cu lacking entirely, and cells bm and dm entirely confluent; cell dm strongly widened to level of crossvein r-m; crossvein dm-cu strongly oblique, resulting in distally pointed cell dm; cell cup shorter and wider at middle, narrowed distally; more or less conspicuous dark pattern present, often restricted to anteromesal part of wing (around cell r_1); halter large, with large knob.

Abdomen: Short, wide and truncate; with 4 preabdominal segments (as in *Nemo*); T1 represented by two small, rounded, lateral sclerites, not united with T2; T2–T4 with distinct furrow along most of posterior margin; terminalia (based on *longarista*): gonites fused, forming cuplike structure; distiphallus completely glabrous; female preabdomen and postabdomen similar to those of *Nemo*, with the following differences: T1 as described above; spermathecae (2) with 3 sclerotized, serially attached globules.

Egg (Fig. 20): Sixteen mature eggs were found in the abdomen of a pinned female

of *longarista*. The egg is elongate oval, slightly more narrowed at the micropylar end, and is 0.4×0.14 mm. The micropylar end is craterlike, packed with pointed projections. The chorion bears a pattern of pentagonal reticulation in the middle of the egg.

The main differences from *Ningulus* (condition in *Ningulus* follows in parentheses) are: Head not depressed (head depressed); 1 long fronto-orbital seta present, often proclinate (several short fronto-orbital setae, not proclinate); posterior notopleural seta more dorsal than anterior notopleural seta (anterior notopleural seta more dorsal); scutellum with 2 pairs setae (3–4 pairs of scutellar setae in the only described species of *Ningulus*, but 2 pairs in an undescribed species from Zimbabwe); stem of vein R, from level of humeral crossvein to fork of vein R_1 , distinctly longer than vein R_1 , distinctly longer than common stem of vein R_{2+3} , and vein R_{4+5} , longer or as long as vein R_{2+3} (stem of vein R distinctly shorter than all these sections); terminal spur of hind tibia indistinct (short but strong).

Etymology.—*Nemula* is a diminutive of the Greek nema, a thread, in reference to the arista. The gender is feminine. It was suggested by Dr. D. K. McAlpine.

Distribution and biology.—*Nemula* is restricted to Madagascar. All three species were collected during the rainy season. Two of the three species were collected from leaves of relatively low *Ravenala madagascariensis* Gmel. (Musaceae). Additional details are given under each species.

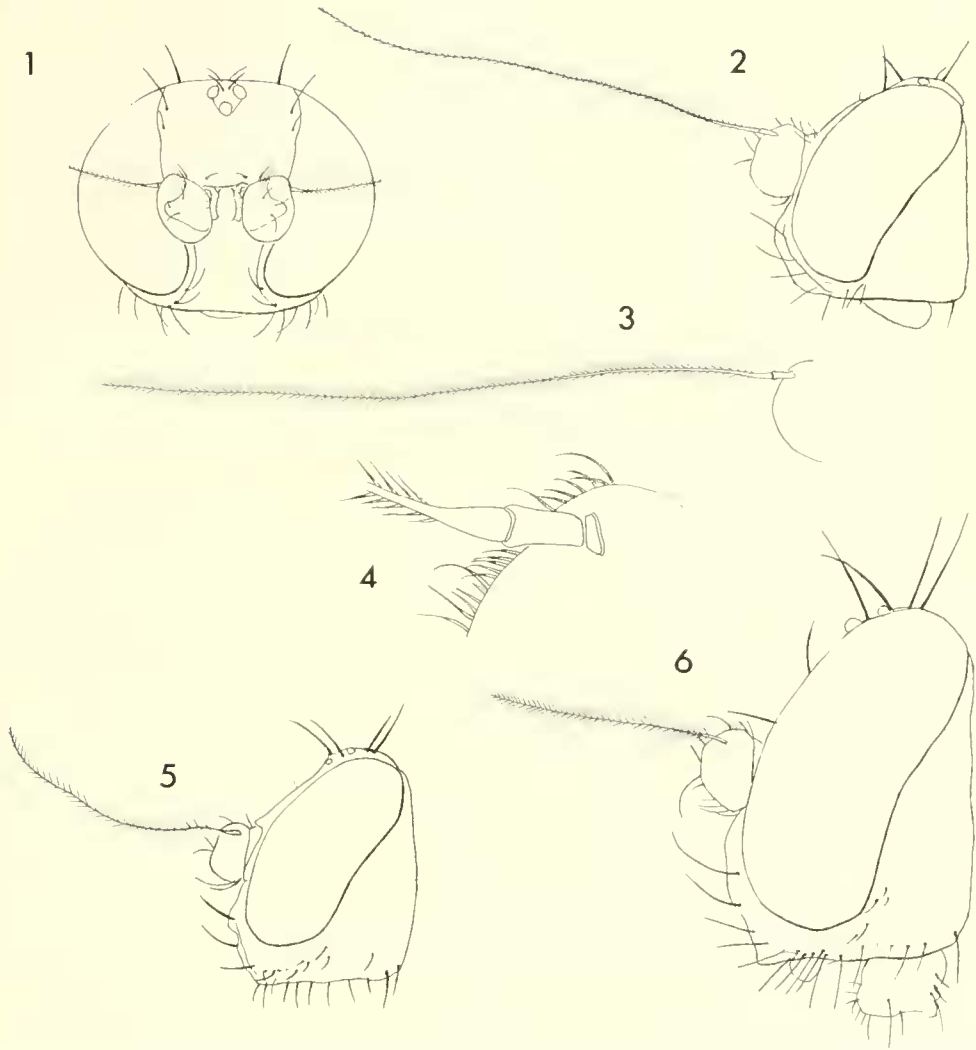
KEY TO THE SPECIES OF *NEMULA*

- 1. Notopleural setae subequal (Fig. 9); scutellum predominantly black, only posterior margin yellow; wing almost uniformly brown, without conspicuous isolated dark spot at level of cell r_1 (Fig. 12); larger species, wing length 2.5 mm (northern Madagascar) *N. major*, new species
- Anterior notopleural seta reduced, much shorter than posterior seta; scutellum entirely or predominantly yellow; wing grayish, with conspicuous dark spot at level of cell r_1 ; smaller species, wing length less than 1.8 mm 2
- 2. Arista extremely long, about 2.5 times as long as head (Fig. 2); anterior dorsocentral seta lacking; basal scutellar seta reduced, much shorter than apical scutellar seta (Fig. 7); silvery areas restricted to narrow band along posteroventral margin of eye; dark spot on wing paler and narrower, not extended to distal half of cell r_1 ; cell r_1 very short (Fig. 10) (central-eastern Madagascar) *N. longarista*, new species
- Arista shorter, about 1.5 times as long as head (Fig. 5); two dorsocentral setae present; scutellar setae subequal, long (Fig. 8); head with wide silvery band extended along posterior and ventral margin of eye and over ventral part of face; dorsal part of anepisternum with similar silvery band; dark spot on wing darker, occupying entire cell r_1 except a narrow central hyaline spot; cell r_1 longer (Fig. 11) (southern Madagascar) *N. argentata*, new species

Nemula longarista Freidberg,
NEW SPECIES

Figs. 1–4, 7, 10, 13–20

Head (Figs. 1–4): *Structure*: Height/length ratio 1.2; strongly triangular in lateral view, with frons and dorsal 1/2 of face generally sloping as a single plane to about mid-height of face, which is strongly protrudent and snoutlike, but face with wide, strongly projected carina between antennae and deep transverse depression between this carina and ventral, snoutlike part; ventral part of face convex, receded, ventral margin aligned only slightly anterior to ventral margin of eye; eye elliptical, nearly parallel to frons; gena narrow, less than half height of 1st flagellomere; postgena about as wide as short diameter of eye; occiput deeply and uniformly concave; frons flat, with weak demarcation of plates, except ocellar triangle; frons width/head width ratio (at vertex) 0.46–0.5; antenna short; scape practically invisible; pedicel large, with distal margin laterally slightly sinusoidal, and mesal margin triangular, strongly projected, almost reaching tip of 1st flagellomere; 1st flagellomere rounded, lateral aspect slightly higher than long; arista dorsal, 3-segmented, extremely long, about 2.5 times as long as head, with long dense rays, in pinned specimens usually upcurved above head; proboscis

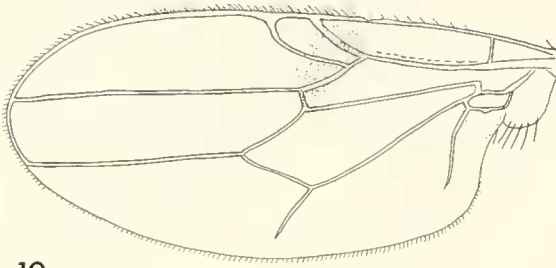


Figs. 1-6. Head and appendages. 1, *Nemula longarista*, anterior view (aristae not shown to the whole length). 2, *N. longarista*, lateral view. 3, *N. longarista*, arista. 4, *N. longarista*, base of arista. 5, *N. argentata*, lateral view. 6, *N. major*, lateral view.

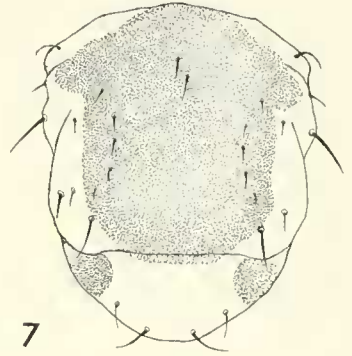
short; palpus small. *Chaetotaxy*: Postocellar setae strongly divergent; vertical seta slightly eclinate; fronto-orbital seta perpendicular, transversely aligned anterior to ocellar setae, with reclinate setula anterior to it; ocellar seta and short mesocline and procline interfrontal setulae present; buccal, genal and row of about 9 "peristomal" setae present; setae on dorsal part of head generally brown; setae on ventral part generally yellow; pedicel with several fine, yellow se-

tae ventrally and several stout blackish setae mesodistally. *Coloration*: Almost entirely yellow to orange yellow, subshiny, with or without sparse grayish microtomentum; dorso-central part of occiput, ocellar triangle, dorsal part of 1st flagellomere and arista blackish; narrow band of denser, silvery microtomentum present along posterior margin of eye.

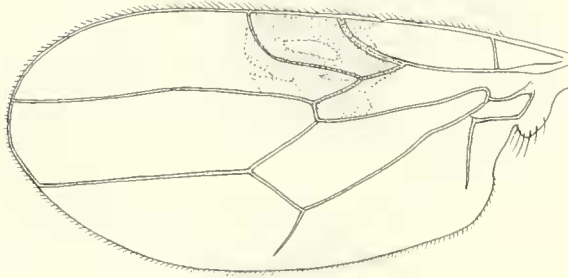
Thorax (Fig. 7): Scutum about as wide as long; scutellum large, rounded, about $\frac{1}{3}$



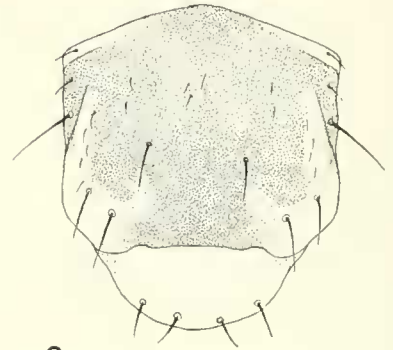
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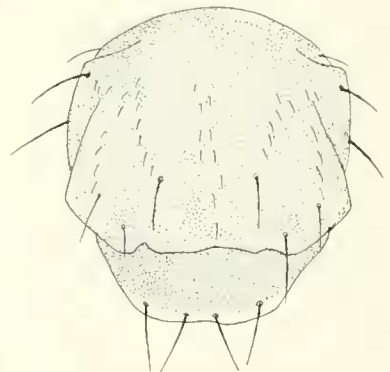
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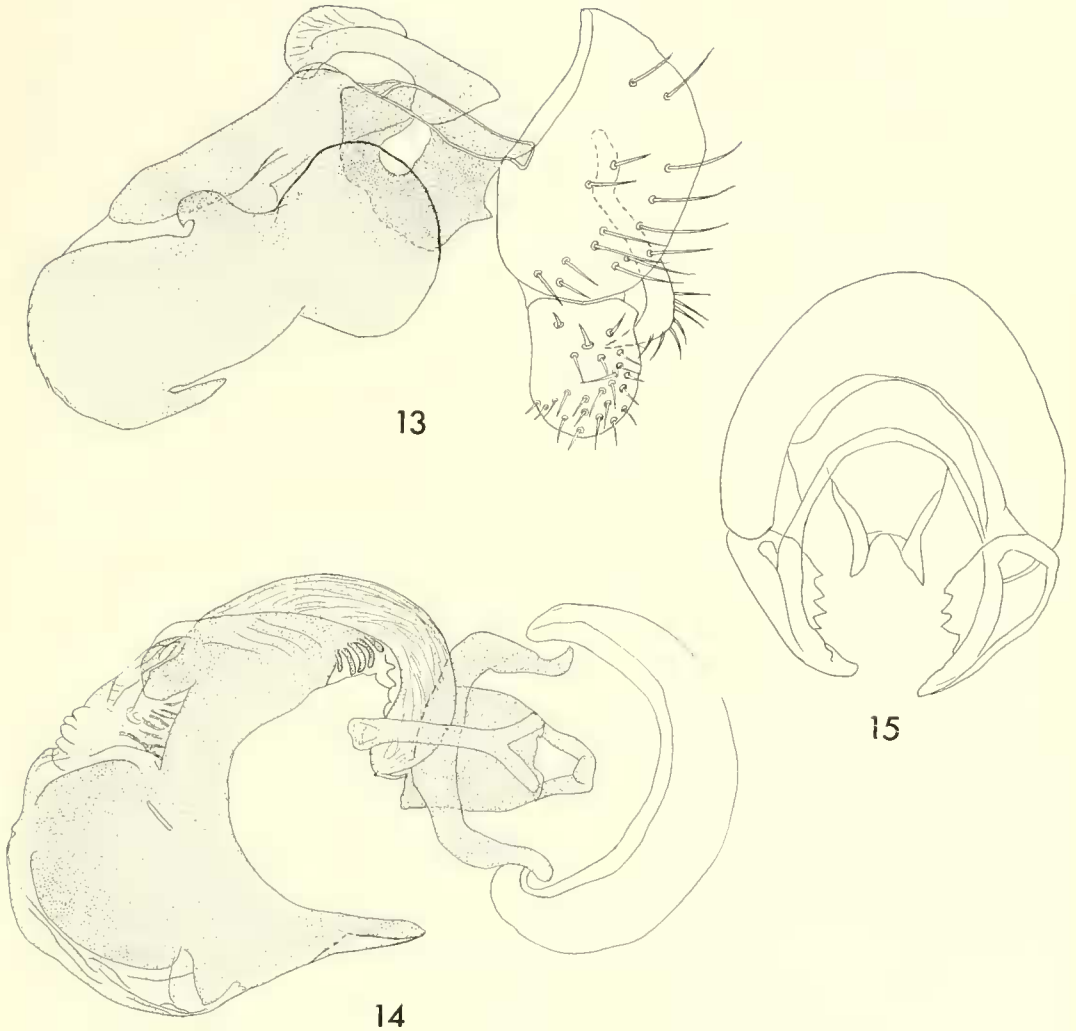


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Figs. 7-12. Thorax, dorsal view, and wing. 7, *Nemula longarista*, thorax. 8, *N. argentata*, thorax. 9, *N. major*, thorax. 10, *N. longarista*, wing (drawn from slide). 11, *N. argentata*, wing. 12, *N. major*, wing (both drawn from pinned specimens).



Figs. 13-15. *Nemula longarista*, male terminalia. 13, lateral view. 14, dorsal view. 15, posterior view.

as long as scutum. *Chaetotaxy*: postpronotal seta small, yellowish; notopleural setae 1 + 1, yellow, anterior much smaller; 1 short intra-alar (perhaps the supra-alar); 1 (posterior) dorsocentral seta; 1 small, brownish, setulalike posterodorsal anepisternal seta; 1 similar, anepimeral seta; 1 long, yellow, kat-episternal seta; scutellum with 2 brown setae: basal seta small, setulalike; apical setae the longest on the body, erect or semi-erect, distantly placed from each other, divergent; no other major setae, although few setulae

on scutum forming dc row, and 2-4 setulae forming uni- or bi-seriate acrostichal rows; thorax predominantly yellow, with large dark brown area occupying most of scutum, except laterally, and base of scutellum, especially laterally; subscutellum similarly dark; all parts subshiny, with sparse gray microtomentum.

Legs: Yellow, distal tarsomere brownish, with long, straight apical setae; other setae short, yellow, but midtibial spur long, brown.

Wing (Fig. 10): As for genus; general tone grayish, with brown spot over weakly delimited pterostigma and basal half of cell r_1 , extended over fork of veins R_{2+3} and R_{4+5} , including base of cell r_{2+3} , to crossvein r-m; alula and anal lobe brownish; costal break distinct; wing length: 1.54–1.8 mm; calyp-teres brownish; halter large, yellowish.

Abdomen: Short and wide; preabdomen with 4 visible segments (Fig. 16); T1 separated into 2 small rounded lateral sclerites, incompletely fused with T2; T2–T4 very wide and short, each with conspicuous submarginal furrow extended almost the entire width of tergite, brown, except narrow yellow margin, shiny, without microtomentum and setae, but with some yellow setulae marginally and laterally; male postabdomen large; surstylus freely articulated with epandrium (Fig. 13), strongly toothed posteriorly (Fig. 15); cercus slender, pointed; hypandrium a simple deeply arcuate sclerite (Fig. 14), open posteriorly, partly surrounding base of distiphallus; gonites fused, forming cuplike structure; aedeagal apodeme normal, forked posteriorly where it meets base of distiphallus; ejaculatory apodeme not observable; distiphallus (Figs. 13, 14) large, heavily sclerotized, curved, becoming bulbous distally, but apex flattened, almost forming a flat disc (which is protrudent from concavity where it is recessed), not setose, but with various ridges. Female postabdomen (Figs. 16, 17); elongate, folding telescopically, when extended about as long as preabdomen; segment V (1st postabdominal segment) with reduced tergite and sternite; tergites and sternites VI and VII vestigial, each appearing as a pair of slender sclerites; tergite and sternite VIII similar but wider. Spermathecae (Fig. 18) 2, each with 3 sclerotized globules, serially attached to each other. Ventral receptacle? (Fig. 19): a sclerotized, bifid structure possibly serves as a sperm reservoir.

Egg (Fig. 20): Sixteen mature eggs were found in the ovaries of a dissected female. The eggs were elongate oval, 0.4×0.14

mm, with conspicuous, craterlike micropylar end, packed with setaelike projections. Chorion mostly smooth, but centrally with distinct reticulation composed of pentagonal or rounded cells.

Etymology.—This species is named for its very long arista.

Material Examined.—Holotype δ , MADAGASCAR E[ast]; Perinet (Andasibe) 16, 17.IV.1991, A. FREIDBERG & FINI KAPLAN, on *Ravenala madagascariensis*. Paratypes: same locality data as holotype (20 δ , 12 ♀). The holotype is double mounted on minute nadel and plastic block, is in excellent condition and is deposited together with most paratypes in the Zoological Museum of Tel Aviv University. Paratypes sent to Australian Museum (Sydney, Australia), The Natural History Museum (London, England) and National Museum of Natural History, Washington, D.C., U.S.A.

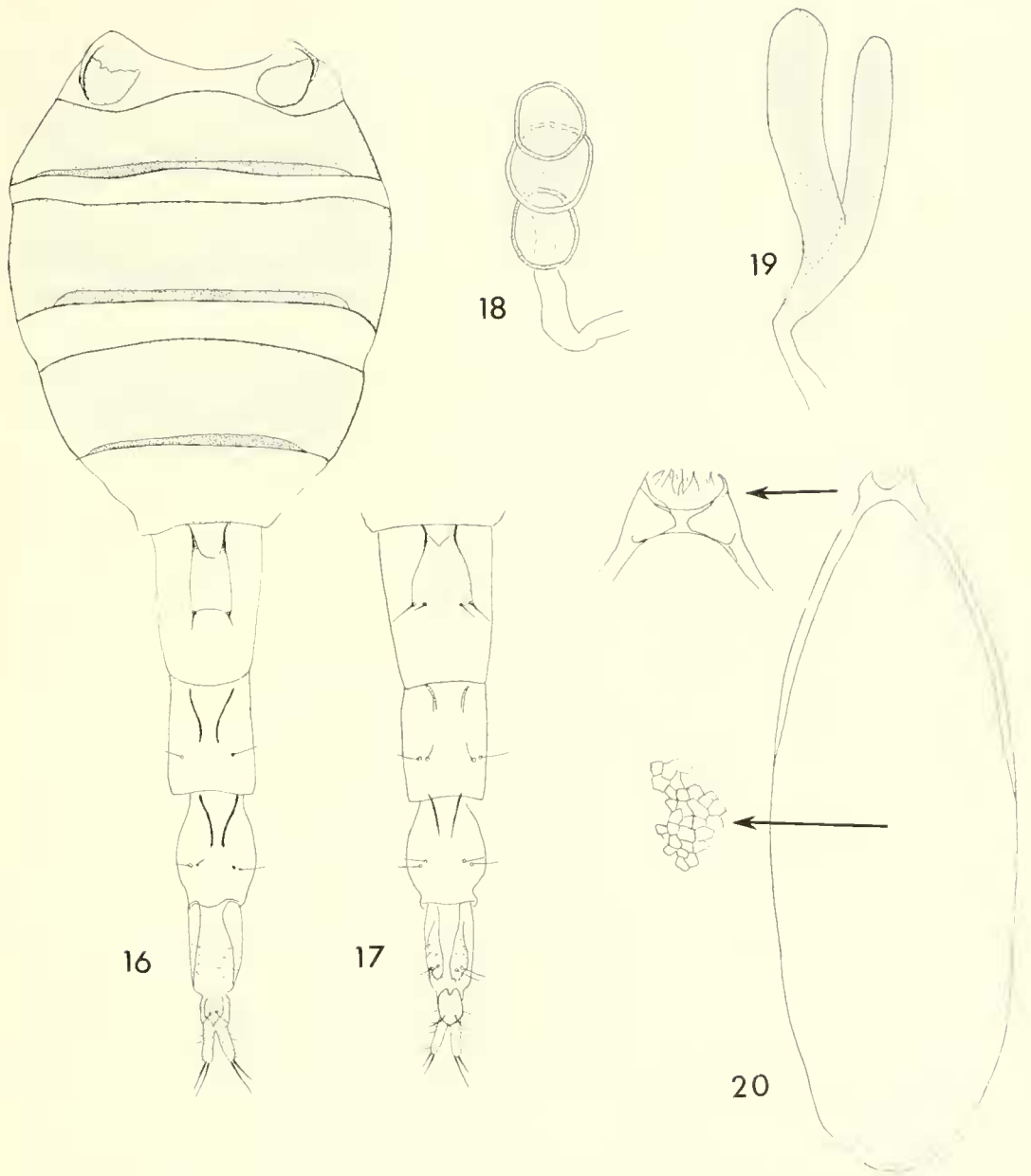
Biology.—All the specimens of the type series were swarming on the upper side of large leaves of *Ravenala madagascariensis*, forming part of the understory of the rather dense and dark forest in Perinet. The movement of the flies on the leaves was similar to that of many other dipterous families (we actually thought that they were chloropids) and entirely different from the side walking of *Stenomicro* Coquillett (Perisclididae) or the back walking of *Neurochaeta* McAlpine (Neurochaetidae), two other taxa that share the same biotope (*Ravenala*) in Madagascar. Another noteworthy observation was that the flies were active despite a continuous rain that moistened the upper side of the leaves entirely.

Nemula argentata Freidberg,

NEW SPECIES

Figs. 5, 8, 11

This species is similar to *longarista* in size and most structural characters but differs predominantly in its dark coloration, presence of a silvery area laterally on the thorax, and more extensive wing pattern. Differences are as follows:



Figs. 16-20. *Nemula longarista*, female abdomen and terminalia. 16, Preabdomen and postabdomen, dorsal view. 17, Postabdomen, ventral view. 18, Spermatheca. 19, Ventral receptacle ?. 20, Ovarian egg (inserts: enlargement of micropyle and chorion reticulation near center of egg).

Head (Fig. 5): Frons width/head width ratio (at vertex) 0.6-0.65; gena wider, almost equal to height of 1st flagellomere; arista shorter, only about 1.5 times as long as head, not upcurved; fronto-orbital setae

transversely aligned posterior to ocellar setae, without additional setula; all cephalic setae dark brown to blackish; head almost entirely orange brown to brown; blackish parts similar to *N. longarista*, except 1st fla-

gellomere, which is entirely orange; wide band of dense, silvery microtomentum present along posteroventral margin of eye, extended to ventral end of parafacial and over ventral part of face, below "snout."

Thorax (Fig. 8): Scutum slightly wider than long; all setae brown or blackish; in addition to setae mentioned for *longarista*, there is a pair of anterior dorsocentral setae transversely aligned slightly posterior to posterior notopleural setae; the 2 scutellar setae are subequal, the basal semi-erect, the apical erect; thorax predominantly brown or brownish, with large dark brown area occupying most of scutum, except posterolaterally, along transverse suture and postpronotum; latter parts yellow; scutellum entirely yellow, although laterally translucent and appearing darker; dorsal part of anepisternum, above seta, nearly horizontal, strongly silvery microtomentose, glistening almost mirrorlike.

Legs: Femora and tibiae, except extremities, dark brown to blackish, remaining parts yellow, but hind leg distinctly darker than other legs; setae brown, midtibial spur black.

Wing (Fig. 11): Generally grayish, with larger blackish spot over pterostigma and cell r_1 , extended likewise to crossvein r-m, but leaving center of cell r_1 hyaline; cell r_1 larger; wing length: 1.7 mm; halter whitish, with yellow stem.

Abdomen: Tergites dark brown, without yellow margins, with sparse microtomentum and without setae; furrow on T3 less conspicuous. Male terminalia not studied.

Female unknown.

Etymology.—This species is named for the silvery patches on the head and thorax.

Material examined.—Holotype ♂, MADAGASCAR S[outh]: 10 km North Fort Dauphin, 18.IV.1991, A. FREIDBERG & FINI KAPLAN, on *Ravenala madagascariensis*. Paratype: same locality data as holotype (1 ♂). The holotype is double mounted on minute nadel and plastic block, is in very good condition and is deposited to-

gether with the paratype in the Zoological Museum of Tel Aviv University.

Biology.—The two specimens comprising the type series were swept from the large leaves of *Ravenala madagascariensis* that grew within a dense boggy patch of forest in the midst of meadows.

Nemula major Freidberg, NEW SPECIES

Figs. 6, 9, 12

This species is similar to *longarista* in most structural characters but differs in the larger size and darker coloration. Differences are as follows:

Head (Fig. 6): Height/length ratio about 1.35; frons width/head width ratio (at vertex) 0.56; face not forming "snout," ventral part only gently curved and receded, ventral margin not approaching ventral end of eye; arista shorter, only about as long as head, not upcurved; fronto-orbital seta transversely aligned posterior to ocellar setae, with additional reclinate setula at midheight of frons; buccal and genal setae present but indistinguishable from numerous "peristomal" and other genal setae; all cephalic setae dark brown to blackish; head almost entirely yellow to orange, subshiny to shiny.

Thorax (Fig. 9): Scutum about 1.2 times wider than long; all setae blackish; two dorsocentral setae; anterior dorsocentral setae transversely aligned midway between posterior notopleural setae and scutoscutellar suture; long katapisternal seta accompanied by several shorter dark setae; katapisternum otherwise densely covered by fine, yellowish setulae; the 2 scutellar setae are subequal, the basal semi-erect, the apical erect; scutum with uniseriate dorsocentral row of setulae, biseriate acrostichal setulae and multiseriate intra-alar (perhaps the supra-alar) setulae; thorax predominantly dark brown to blackish, with pleura becoming paler ventrad and posterior margin of scutellum yellow; scutum and scutellum with dense grayish microtomentum, barely shiny; pleura subshiny with lighter microtomentum.

Legs: Femora and tibiae, except extremities, brown to blackish, remaining parts yellow, but forefemur more yellowish brown; setae brown, midtibial spur black.

Wing (Fig. 12): Almost uniformly brown, although basally and posteriorly somewhat lighter, without distinct dark spot from pterostigma to crossvein r-m; wing length: 2.5 mm; halter with blackish knob and yellow stem.

Abdomen: Similar to *longarista*, but slightly darker, with darker setulae.

Male terminalia not studied.

Female unknown.

Etymology.—This species is named for its size, which is the greatest in the family.

Material examined.—Holotype ♂, MADAGASCAR N[orth]; Ambohitra, 800m, Joffreville, 9-12.IV.1991, A. FREIDBERG & FINI KAPLAN. The holotype is double mounted on minute nadel and plastic block, is in excellent condition and is deposited in the Zoological Museum of Tel Aviv University.

Biology.—The holotype, which is the only known specimen, was collected by general sweeping of diverse vegetation in the understory of a forest. No *Ravenala madagascariensis* was detected at the site.

DISCUSSION

This study treats *Nemula*, a new genus from Madagascar, which is placed in the family Neminidae McAlpine. This little known family of acalyptrate flies (raised here from subfamily) formerly included only two genera: *Nemo* McAlpine, with seven species from Australia and Papua New Guinea, and *Ningulus* McAlpine, with one species from South Africa. Together with the three species of *Nemula*, described in this paper, the Neminidae comprise today only eleven species. Additional, undescribed, species are known to occur in Australia (*Nemo*) and Zimbabwe (*Ningulus*) (D. K. McAlpine, personal communication) and probably also in Madagascar.

Despite the small size of this group it is

accorded here family status as it is distinguished from the Aulacigastridae by at least 18 characters. Although the number of (described and undescribed) known taxa is increasing in the two groups, respectively, these groups do not show substantial tendency for overlapping or intergradation in their specific combinations of characters. The habitus of flies of the Asteioinea (the superfamily containing the Aulacigastridae, Periscelididae etc.) and their behaviors are so characteristic as to render most of them easy to assign to family, even without optical aids in the field (e.g. McAlpine 1988, Freidberg 1984). D. K. McAlpine (personal communication) adds additional characters that distinguish the Neminidae from the Aulacigastridae but, nevertheless, is doubtful about the elevation of the former to family status.

Aulacigastridae and Periscelididae have been considered sister groups (e.g. McAlpine 1989), but various included genera have often been transferred from one family to another. The most "notorious" genus in this regard is *Stenomicro* Coquillett, which recently was accorded family status (Papp 1984). As Nemininae is raised to family status, its sister group may or may not remain the Aulacigastridae. Likewise, the Periscelididae (including *Stenomicro*) may or may not be the sister group of the Aulacigastridae or Aulacigastridae+Neminidae. In any case, and as McAlpine (1989) has advocated, a thorough phylogenetic study of all genera in these families is needed to resolve their relationships.

A thorough cladistic study is also needed to better understand the relationships within the Neminidae. At this point it would suffice to suggest the following: *Nemo* is probably the most generalized genus of the family and *Ningulus* the most evolved. *Nemula* is probably the sister group of *Nemo*, and together both form the sister group of *Ningulus*. The reasoning behind these conclusions lies in the similar habitus of *Nemo* and *Nemula*, whereas *Ningulus*, with its

prolonged head, has apparently passed a more conspicuous step in evolution. It should be remembered, however, that certain wing venational characters, which are synapomorphies of the species of *Nemula*, are also remarkable, although perhaps less conspicuous than the head shape of *Ningulus*. One of these characters, the prolongation of vein R, especially between the humeral crossvein and the first furcation of R (furcation between R_1 and remaining branches of R) is similar to some Nematocera and "Orthorrhaphous" Brachycera but is exceptional and may even be unique in the Muscomorpha. If we examine the above-mentioned hypothesis against the known distribution of the Neminidae, it appears that this group has originated in the Australasian region, with *Nemo* or *Nemo*-like ancestor, and has spread westwards, leaving an offshoot (*Nemula*) in Madagascar, and culminating in *Ningulus* on the southern part of mainland Africa.

Finally, while reviewing a manuscript of this paper, Dr D. K. McAlpine kindly informed me about several undescribed Neminidae in his possession and their characters. These include a species of *Ningulus*, with only 2 pairs of scutellar setae and slightly different wing venation than in the described species, and several *Nemo* species with only one (apparently the outer) vertical seta. These findings might eventually affect the classification of the family. However, not having studied these taxa myself, I refrain from incorporating all these data into this study (these two extraordinary characters are merely mentioned above in the key to genera). This will be better done, pending descriptions of these taxa.

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LITERATURE CITED

- Evenhuis, N. L. 1989. 73. Family Aulacigastridae, p. 549. In Evenhuis, N. L., ed., Catalog of the Diptera of the Australasian and Oceanian regions. Bishop Museum Press and E. J. Brill. 1155 pp.
- Ferrar, P. 1987. A guide to the breeding habits and immature stages of Diptera Cyclorrhapha. Entomograph 8. E. J. Brill/Scandinavian Science Press. 907 pp.
- Freidberg, A. 1984. The mating behavior of *Asteia elegantula*, with biological notes on some other Asteiidae (Diptera). Entomologia Generalis 9(4): 217-224.
- McAlpine, D. K. 1983. A new subfamily of Aulacigastridae (Diptera: Schizophora), with a discussion of aulacigastrid classification. Australian Journal of Zoology 31: 55-78.
- . 1985. A new species of Aulacigastridae from Papua New Guinea and characterisation of species groups in the genus *Nemo* (Diptera, Schizophora). Australian Entomological Magazine 12(3,4): 47-50.
- . 1988. Studies in upside-down flies (Diptera: Neurochaetidae). Part II. Biology, adaptations, and specific mating mechanisms. Proceedings of the Linnaean Society of New South Wales 110(1): 59-82.
- McAlpine, J. F. 1981. Morphology and terminology—adults, pp. 9-36. In McAlpine, J. F. et al., eds., Manual of Nearctic Diptera. Volume 1. Hull (Quebec): Agriculture Canada, Research Branch. (Monograph; No. 27).
- . 1989. Phylogeny and classification of the Muscomorpha, pp. 1397-1518. In McAlpine, J. F. et al., eds., Manual of Nearctic Diptera. Volume 3. Hull (Quebec): Agriculture Canada, Research Branch. (Monograph; No. 32).
- Papp, L. 1984. Family Stenomericidae, pp. 61-62. In Soós, A. and L. Papp, eds., Catalogue of Palaearctic Diptera, Vol. 10. Elsevier Science Publishers, Amsterdam.